Michigan Department of Environmental Quality
Environmental Science & Services Division
and
Water Bureau

Study Guide of Typical Exam Content for Waterworks Operator Certification Examinations

LIMITED TREATMENT

D CLASSIFICATIONS

D-4 Entry Level of Certification
D-3 Intermediate Level of Certification
D-2 Advanced Level of Certification
D-1 Highest Level of Certification

Written Examinations: The written examinations for all classifications are developed from need-to-know type exam questions. The design of the questions has been selected so that they are clear, not misleading or tricky.

Style of Questions: All exam questions are multiple choice. The style of questions and number of questions may change without notice.

Exam Content: The subjects typically covered on the various certification examinations are grouped by exam on the following pages. These subjects may change without notice.

D-4 & D-3 Study Guide

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Corrosion

Definition, causes/effects/prevention of corrosion on interiors/exteriors, Langelier Index.

Cross Connections

Definition, types, causes, prevention and/or correction (devices and when each is used), which agency is responsible for inspections. testing of devices.

Disinfection

Chemicals used, all aspects of disinfection with chlorine (PPM calculations, residual, available concentration, demand, and dose etc.), methods of measuring chlorine residual, storage, testing, handling, safety, etc. of chlorine.

Emergencies and Security

Contingency plan (requirements, key topics, examples, etc).

Fluoridation

Chemicals used, dosage calculations, reasons for addition, safety and handling, regulations (sampling frequency).

Hardness/Softening

Causes/effects, dosage calculations.

Hydraulics

Definitions, volume, density, specific gravity, area, circumference, pressure/hydraulic head calculations, detention time, abbreviations/conversions.

Instrumentation

What processes should be instrumented and why? Type of instrumentation (flow meters, valves, etc.) Measuring & control of water equipment such as float levels and weirs, flow measurements, pressure controls, electrical controls.

Iron Removal

Processes to remove or stabilize the iron (aeration, potassium permanganate, phosphate addition, etc.) filter backwash rate calculations.

Laboratory

Procedures, techniques, equipment, medias, preservatives, calculations, thorough understanding of results, routine testing, etc.

Management

How to handle given management situations (town meetings, employee discipline or motivation, hostile customers, etc.)

Membrane Technology

Types of membranes (reverse osmosis, microfiltration, etc.), selectivity of membranes, cleaning of membranes.

Microbiology

Definitions, testing procedures, standard methods for analysis, medias used etc. Classification of waterborne diseases (viruses, bacteria, protozoa, etc), indicator organisms (name, purpose, etc.), reporting of results.

O & M

Procedures for general & preventative maintenance of equipment, trouble shooting, operational procedures and common installations.

Phosphate

Optimum dose, dosage calculations, advantages/disadvantages of application, solubility in water.

Public Relations

Principles to maintain a good public image, contact with the public and handling customer complaints.

Pumps & Motors

Understanding of pumps and motors, their operation, types, trouble shooting, calculations, etc.

Recordkeeping

Water quality & samples results (bacteriological and chemical), MDEQ operation reports, data management.

Safety

Personal & site safety associated with chemicals, equipment, maintenance operations, etc., confined spaces (define, give examples, entry procedures, etc.)

Sampling

Procedures (pre-sampling, sampling - bacteriological/chemical, Pb/Cu), results (understand and interpret), routine sampling (regulation, benefits, etc), sample preservation techniques and handling procedures.

SDWA

Michigan Safe Drinking Water Act as amended, (rules and regulations), National Primary & Secondary Drinking Water Standards, operator certification, MCL's, notification, regulated compounds, etc., public health.

Taste & Odor

Causes and solutions to taste and odor complaints, Standard Methods tests.

Wells

Definitions; groundwater hydrology, monitoring schedules, pumpage logs, maintenance, etc., isolation area (define, size, etc.), good housekeeping in a pump/well house (explain, give examples, etc.), firm capacity (define, examples, etc.), well casing appurtenances (vents, valves, etc.)

D-2 Study Guide

Corrosion

Causes/effects of corrosion on interiors/exteriors, Langelier index.

Cross Connections

Definition: prevention and/or correction (devices and when each is used). What agency is responsible for inspections?

Disinfection

All aspects of disinfection with chlorine (PPM calculations, residual, available concentrations, demand, etc.) methods (DPD, storage, testing, handling, safety, etc), UV and ozone.

Emergency/Security

Contingency Plan (requirements, key topics, examples, etc.)

Fluoridation

Dosage calculations, reasons for addition, fluoride compounds used, analysis technology, etc.

Hardness/Softening

Causes/effects, ion exchange units, etc.

Hydraulics

Volume, density, area, circumference, and pressure/hydraulic head calculations, abbreviations/conversions.

Instrumentation

What processes should be instrumented and why? Type of instrumentation (flow meters, valves, etc.)

Iron Removal

Processes to remove or stabilize the iron (aeration, potassium permanganate, phosphate addition, etc.), filter backwash rate calculations.

Laboratory Procedures

Procedures, techniques, equipment, medias, preservatives, etc., through understanding of results, routine testing, etc.

Management

How to handle given management situations (town meetings, employee discipline or motivation, hostile customers, etc.)

Membrane Technology

Types of membranes (reverse osmosis, microfiltration, etc.), selectivity of membranes, cleaning of membranes.

Microbiology

Testing procedures, standard methods for analysis, medias used, etc., classification of waterborne diseases (viruses, bacteria, protozoa, etc.), indicator organisms (name, purpose, etc.)

O & M

Operational procedures and common installations.

Phosphate

Optimum dose, dosage calculations, advantages/disadvantages of application, solubility in water.

Public Relations

Describe situations where you may come in contact with the public, how to handle these situations and maintain a good public image.

Pumps & Motors

Understanding of pumps, motors, their operation, types, trouble shooting, pump curves, etc.
Be able to calculate the dynamic head and horsepower for given pump specifications.

Recordkeeping

Water quality & sample results (bacteriological/chemical, MDEQ operation reports, advantages of recordkeeping with respect to treatment efficiency.

Safety

Personal & site safety associated with chemicals, equipment, maintenance operations, etc.
confined spaces (define, give examples, entry procedures, etc.)

Sampling

Procedures (pre-sampling, sampling bacteriological/chemical, Pb/Cu, nitrates, etc.)
Results (understand & interpret), routine sampling (regulations, benefits, etc.)

SDWA

Michigan Safe Drinking Water Act as amended. National Primary & Secondary Drinking Water Standards, rules & regulations, operator certification, MCL's, notification, regulated compounds, etc.)

Taste & Odor

Standard Methods Test, causes, solutions, etc.

Wells

Groundwater hydrology, monitoring schedules, pumpage logs, maintenance & rehabilitation, etc.
Isolation area (define, size, etc.), good housekeeping in a pump/well house (explain, give examples, etc.), firm capacity (define, examples, etc.), well casing appurtenances (vents, valves, etc.)

D-1 Study Guide

Corrosion

Causes/effects of corrosion on interiors/exteriors, Langelier Index.

Cross Connections

Definition, prevention and/or correction (devices and when each is used). What agency is responsible for inspections? Be able to give examples of cross connections.

Disinfection

All aspects of disinfection with chlorine (PPM calculations, residual, available concentration, demand, etc.) methods (DPD, storage, testing, handling, safety, etc), UV and ozone.

Emergency/Security

Contingency plan (requirements, key topics, examples, etc.)

Fluoridation

Dosage calculations, reasons for addition, fluoride compounds used, analysis technology, etc.

Hardness/Softening

Causes/effects, softening calculations, temperature effects, etc.
Describe the ion exchange process (regeneration, typical resins, removal calculations, etc.)

Hydraulics

Volume, density, area, circumference, and pressure/hydraulic head calculations abbreviations/conversions.

Instrumentation

What processes should be instrumented and why? Types of signals used. Type of instrumentation (flow meters, valves, solenoids, thermocouples, floats, etc.)

Iron Removal

Processes to remove or stabilize the iron (aeration, potassium permanganate, phosphate addition, etc.), filter backwash rate calculations.

Laboratory Procedures

Procedures, techniques, equipment, medias, preservatives, etc., through understanding of results, routine testing, etc.

Management

How to handle given management situations (town meetings, employee discipline or motivation, task delegation, hostile customers, etc.)

Membrane Technology

Types of membranes (reverse osmosis, microfiltration, etc.), selectivity of membranes, cleaning of membranes.

Microbiology

Testing procedures, standard methods for analysis, medias used, etc., classification of waterborne diseases (viruses, bacteria, protozoa, etc.), indicator organisms (name, purpose, etc.)

O & M

Operational procedures and common installations.

Phosphate

Optimum dose, dosage calculations advantages/disadvantages of application, solubility in water.

Public Relations

Describe situations where you may come in contact with the public, how to handle these situations and maintain a good public image.

Pumps & Motors

Understanding of pumps, motors, their operation, types, trouble shooting, pump curves, etc.
Be able to calculate the dynamic head and horsepower for given pump specifications.

Recordkeeping

Water quality & sample results (bacteriological/chemical), MDEQ operation reports, advantages of recordkeeping with respect to treatment efficiency.

Safety

Personal & site safety associated with chemicals, equipment, maintenance operations, etc.
Confined spaces (define, give examples, entry procedures, etc.)

Sampling

Procedures (pre-sampling, sampling bacteriological/chemical, Pb/Cu, nitrates, etc.). Results (understand & interpret), routine sampling (regulations, benefits, etc.)

SDWA

Michigan Safe Drinking Water Act as amended, National Primary & Secondary Drinking Water Standards, rules & regulations, operator certification, MCL's, notification, regulated compounds, etc.)

Taste & Odor

Standard Methods Test, causes, solutions, etc.

Wells

Groundwater hydrology, monitoring schedules, pumpage logs, maintenance, rehabilitation, disinfection techniques, etc., good housekeeping in a pump/well house (explain, give examples, etc.), firm capacity (define, examples, etc.), well casing appurtenances (vents, valves, etc.)
Understand all aspects of wells (construction, isolation area, surface contaminant protection, etc.)

The following is a list of selected references for the **D-1 and D-2 examinations only**.

- Michigan Safe Drinking Water Act, Act 399, P.A. 1976 as amended
- Water Treatment Plant Operation, Volume I, California State University, Sacramento, CA, 4th or 5th Edition
- Water Treatment Plant Operation, Volume II, California State University, Sacramento, CA, 3rd Edition
- Water Distribution System Operation & Maintenance, California State University, Sacramento, CA, 4th or 5th edition
- Small Water System Operation & Maintenance, California State University, Sacramento, CA, 4th Edition
- MDEQ Cross Connection Rules Manual, Third Edition
- Water Distribution and Limited Chemical Treatment Review Manual 3rd edition 2004 Michigan Section AWWA
- Hydraulics for Operators, Revised Edition, Wm. Elgar Brown, 1985, Michigan Section AWWA
- Water Treatment Membrane Processes, AWWARF, McGraw Hill, 1996

The following is a list of selected references for the **D-3 and D-4 examinations only**.

- Water Treatment Plant Operation, Volume I, California State University, Sacramento, CA, 4th or 5th Edition
- Water Treatment Plant Operation, Volume II, California State University, Sacramento, CA, 3rd Edition
- Water Distribution System Operation & Maintenance, California State University, Sacramento, CA, 4th or 5th edition
- Small Water System Operation & Maintenance, California State University, Sacramento, CA, 4th Edition
- Standard Methods for the Examination of Water and Wastewater, 20th edition
- Michigan Safe Drinking Water Act, Act 399, P.A. 1976 as amended

The Michigan Safe Drinking Water Act can be found on the Internet at www.michigan.gov/deq. After you get to this site, click on **Water** and then **Drinking Water** and then **Community Water**. If you scroll down with your cursor, you can locate the laws that will include the Michigan Safe Drinking Water Act.